

The Definition of a Shipyard's Engineering Requirements to be Met by a Design Agent

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THE DEFINITION OF
A SHIPYARD'S ENGINEERING REQUIREMENTS
TO BE MET BY A DESIGN AGENT

A Project of
The National Shipbuilding Research Program
for
The Society of Naval Architects and Marine Engineers
Ship Production Committee
Design/Production Integration Panel SP-4

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The Definition of a Shipyard's Engineering Requirements to be Met by a Design Agent

EXECUTIVE SUMMARY

Shipyards face a major problem in managing the flow of information across the interface with an outside design agent. The purpose of this report is to provide a generic listing of the requirements for a shipyard's engineering support contract. The generic list can provide the basis for a modified listing for each specific contract.

The generic listing of requirements was developed in conjunction with eight shipyards and five design agents. The contributions of each organization and individual were valuable and assisted in the development of the final listing.

The listing of a shipyard's requirements was structured in five major elements.

1. Shipyard specific information
2. Project specific information
3. Shipyard imposed project specific requirements
4. Required deliverables
5. Required schedule of deliverables

The conclusions and recommendations include:

- L That the check-off list be used in the preparation of engineering support contracts.
2. That the use of the check-off list does not preclude the need for direct liaison between the shipyard and the design agent.
3. That the shipyard and design agent should review the check-off list against their current contracts to ensure that they have or will provide the required data.

1. BACKGROUND

The specific information about the shipyard that is needed in order for the shipyard's "in house" engineering department to provide support for the ship construction process is normally resident within the engineering department. However,

because of the cyclical nature of today's shipbuilding market, not all shipyards are able to maintain a full design staff. Some of these shipyards maintain a “core” engineering group capable of managing a preliminary or detail design effort prepared by an outside design agent. In that case, designs for products which are to be built and/or assembled in the shipyard will be prepared by design agent personnel who may have little or no history and knowledge of the shipyard's design and construction capabilities and practices. Simply stated, the shipyard's problem is how to identify and communicate the vast amount of information which must flow across the interface, in both directions, to enable the outside design agent to prepare a usable design product at a cost efficient price.

The permanent shipyard engineering staff who manage the contract, have to bridge the interface between the shipyard and the “temporary” design personnel who will be doing the design work. In order to fill this role, the permanent shipyard staff must have a thorough knowledge of the shipyard's specific requirements based upon the shipyard's capabilities, facilities and past practices as well as a solid understanding of the “process” of how a ship is designed and built at their yard in order to obtain a product from the design agent which is usable by the shipyard production departments. Not only must the shipyard personnel have the information, but they have to communicate it to the design agent in a timely fashion to avoid rework and increased costs. The design agent needs to know certain information about the shipyard, the details of the current ship construction project, how the shipyard plans to build the ship, the design output required and when the deliverables are required in order to properly support the shipyard.

Although each shipyard's requirements may vary in some details, a set of generic requirements for an engineering support contract can be developed. These generic requirements would then be available for modification as required for each specific contract. The listing of generic requirements would assist both the shipyard and the design agent in assuring that the required information has been discussed and either has

or will be transmitted between their organizations in a timely fashion.

The purpose of the task which is the subject of this report was to develop and define such a list.

2. THE GOAL

The goal of this project is to identify the information which needs to be provided by the shipyard to the design agent as well as the deliverables which the design agent is required to provide to the shipyard. This information must be sufficient to ensure that the products of the design agent are directly usable by the shipyard, with negligible rework generated as a result of the shipyard's review of the design agent's products. By being able to identify the information to be transmitted, by as early as the initial stages of negotiation between the two parties, not only will adequate information flow be ensured, but more accurate cost estimates for the design agent's efforts should be possible. The timeliness of information flow will also be enhanced, since schedules can be developed and managed throughout the process.

3. THE APPROACH

The approach followed in performing this task was to divide the work into the four tasks described in detail in the following sections. Assistance was requested from a number of shipyards and design agents, most of whom agreed to participate in the project. Some of the shipyards and design agents provided copies of contracts and other documentation used in previous projects to serve as a starting point in developing the questionnaire. All of the participants contributed valuable time and effort to the project and made significant comments and suggestions which improved the value and completeness of the final product. The tasks were as follows:

Task 1. Develop Data for Survey Questionnaire

A number of shipyards and design agents were contacted and invited to participate in the project. In depth inquiries were made with several of the shipyards and design agents to obtain and compile sufficient information to prepare the basic questionnaire to be sent to the larger group of participants as listed in Section 4. The

2questionnaire was then prepared as described in Section 5.

Task 2. Conduct Survey

The questionnaire was mailed to the participating organizations for completion. Follow up visits and phone calls were made as necessary to clarify the information requested and to establish a common understanding of each item.

Task 3. Complete and Distribute the Initial Draft

The responses received from the participants were tabulated and reviewed. Additions and deletions were made to the listing based upon the numerous comments received with the completed questionnaires. The tabulated and revised responses were then mailed to the various participants for any additional comments.

Task 4. Prepare Final Report

This final report was prepared and submitted. Included as Appendix B is the final listing of engineering data which should be provided by a shipyard to a design agent providing engineering and design support services. This listing is intended to serve as an overall check-off list to insure that future engineering support service contracts consider the information which should be provided in structuring the contract.

4. THE PARTICIPANTS

The following organizations participated in the project. Many individuals within each group made valuable contributions of both their knowledge and time.

4.1 Shipyards

- 4.1.1 Avondale Industries Inc. (ASI)
- 4.1.2 Bethlehem Steel Company (BSC)
- 4.1.3 Bath Iron Works (BIW)
- 4.1.4 Ingalls Shipbuilding Division (ISD)
- 4.1.5 McDermot (McD)
- 4.1.6 National Steel and Shipbuilding Co (NASSCO)
- 4.1.7 Peterson Builders Inc (PBI)
- 4.1.8 Textron Marine Systems (TMS)

- 4.2 Design Agents
 - 4.2.1 CDI Marine
 - 4.2.2 Gibbs and Cox (G&C)
 - 4.2.3 JJH
 - 4.2.4 John J. McMullin & Associates (JJMA)
 - 4.2.5 M. Rosenblatt and Son (MRS)
- 4.3 Shipyard Organizations Involved
 - 4.3.1 Engineering
 - 4.3.2 Material
 - 4.3.3 Planning
 - 4.3.4 Production
 - 4.3.5 Program management
 - 4.3.6 Contracts
- 4.4 Design Agent Organizations Involved
 - 4.4.1 Engineering
 - 4.4.2 Design
 - 4.4.3 Management

5. THE QUESTIONNAIRE

5.1 Questionnaire Structure- Top Level

The questionnaire was prepared as a draft of a checklist for statement of requirements(SOR) for engineering support services.

The check list was structured in a work breakdown format with the top level being the five major elements of information which should be provided in a SOR. The five major elements of the listing were:

1. Shipyard specific information
2. Project specific information
3. Shipyard imposed project specific requirements
4. Required deliverables

5. Required schedule of deliverables

5.2 Questionnaire Structure- Second Level

The five major elements of the top level were broken down in to a second level as follows:

1. SHIPYARD SPECIFIC INFORMATION

- 1.1 Shipyard Organization
- 1.2 Shipyard Facilities
- 1.3 Shipyard Capabilities
- 1.4 Shipyard Standards and Practices

2. PROJECT SPECIFIC INFORMATION

- 2.1 Contract
- 2.2 Specifications
- 2.3 Contract Drawings
- 2.4 Contract Guidance Drawings
- 2.5 Project Peculiar Documents
- 2.6 Third Tier References
- 2.7 Approval Procedures
- 2.8 Owner Data Requirements
- 2.9 Other Owner Requirements

3. SHIPYARD IMPOSED PROJECT SPECIFIC REQUIREMENTS

- 3.1 Build Strategy
- 3.2 Proposed Construction Plan
- 3.3 Proposed Construction Schedules
- 3.4 Proposed Test Program
- 3.5 Drawing Format and Content
- 3.6 CAD/CAE/CAM
- 3.7 Other Production Information
- 3.8 Liaison Procedures

- 3.9 Change Procedures
- 3.10 Design Reviews
- 3.11 Quality Assurance
- 3.12 Work Tracking and Status Reports
- 4. REQUIRED DELIVERABLES
 - 4.1 Design Calculations and Studies
 - 4.2 System Drawings
 - 4.3 Composite Drawings
 - 4.4 Installation/Assembly Drawings
 - 4.5 Fabrication Drawings
 - 4.6 Schedules, List/Booklets
 - 4.7 Other Drawings
 - 4.8 Vendor Drawings
 - 4.9 Work Packages
 - 4.10 Test Program Documentation
 - 4.11 Material Procurement Documents
 - 4.12 Vendor Documentation
 - 4.13 Technical Documentation
 - 4.14 Samples provided
- 5. REQUIRED SCHEDULES OF DELIVERABLES
 - 5.1 Required Dates for Design Calculations and Studies
 - 5.2 Required Dates for System Drawings
 - 5.3 Required Dates for Composite Drawings
 - 5.4 Required Dates for Installation/Assembly Drawings
 - 5.5 Required Dates for Fabrication Drawings
 - 5.6 Required Dates for Schedules/Lists/Booklets
 - 5.7 Required Dates for Other Drawings
 - 5.8 Required Dates for Vendor Drawings

- 5.9 Required Dates for Work Packages
- 5.10 Required Dates for Test Program Documentation
- 5.11 Required Dates for Material Procurement Documents
- 5.12 Required Dates for Vendor Documentation
- 5.13 Required Dates for Technical Documentation
- 5.3 Questionnaire Instructions

The following information and instructions were transmitted to the participants as guidelines for their responses:

“This document is the first draft of a listing of information that a shipyard should convey to a design agent with the Statement of Requirements (SOR) for Engineering Support Services to insure that the products received by the shipyard are of the desired quality and are directly usable. The purpose of this questionnaire is to test the checklist against existing practices and to identify those items of information which you believe should be added or deleted from the list.”

“For a shipyard respondent:

Please review the following check off list and:

1. check whether your organization currently provides the information indicated with the Statement of Requirements (SOR),
2. check whether you believe that the item should be provided,,
3. add any additional items that you believe should be included with the listing:’

“For a design agent respondent:

Please review the following check off list and:

1. check whether you normally receive the information with a SOR,
2. check whether you believe that the item should be provided with the SOR to facilitate your performance,
3. add any additional items that you believe should be included with the listing:’

5.4 Questionnaire Follow-Up

Rather than simply wait for the questionnaires to be returned for analysis, the approach taken for this project was to visit as many of the respondents as practicable and discuss their responses with them. This turned out to be most valuable, since it allowed the team to resolve questions that were not originally clear to the respondents. It had the additional benefit of providing valuable feedback in comments that went beyond the scope of the questionnaire but were directly related to the efficiency and effectiveness with which shipyards can overcome information flow deficiencies, changes, and other obstacles to production support.

6. THE RESULTS

The following is a summary of the responses received from the questionnaire.

6.1 Responses

The responses to the questionnaires were very positive. None of the items listed in the questionnaires were rejected as unimportant, unnecessary or extraneous. The one problem that affected the data received from the shipyards was due to a lack of clarity in the wording of the questionnaire. When answering the question about their current practices, those shipyards which are not currently farming out a specific type of work answered “No” to that question even if they thought that the answer should be “yes” if the work were farmed out. The actual intent of the questionnaire was to find out whether they agreed that the information cited would be needed IF the shipyard were to farm out that type of work. Fortunately, the follow-up visits by team members were able to clarify this matter in many instances. Appendix A provides a summary tabulation of the responses received to the original checklist items.

6.2 Additions

A number of suggested additions to the original list of information items required were received from the respondents. Some of the original items were found to require additional description. All of these additions and modification have been made to and included in the final listing, which is provided as Appendix B.

add at: 1.2.16	Computer programs in use
add at: 1.2.17	Material ordering limitations
add at: 1.3.3.7	HVAC
add at: 1.3.4	Union labor constraints
add at: 1.3.4	Interface required with other vendors & suppliers
add at: 2.1.2	Copy of contract
add at: 2.8.5	COSAL
add at: 3.1.3	Product Work Breakdown Structure
add at: 3.1.4	Pre-outfitting sequence
add at: 3.6.4	Control of CAD/CAE/CAM file
add at: 3.8.6	Frequency of reports
add at: 4.1.1	Weight estimate
add at: 4.1.2	Inclining experiment report
add at: 4.2.9	Compartment and access drawings
add at: 4.7.1	Vendor geometry drawings
add at: 4.7.2	Vendor compliance drawings
add at: 4.7.3	Vendor MilSpec drawings
add at: 4.8.1	Closure lists
add at: 4.8.2	Label plate
add at: 4.8.3	Cableways
add at: 4.8.4	Lighting
add at: 4.8.5	Shafting
add at: 4.8.6	Joiner
add at: 4.8.7	Insulation
add at: 4.8.8	Deck covering
add at 4.11.3	Inquiry specifications
add at 4.11.4	Purchase specifications

7. THE ANALYSIS

The following is a listing of some of the significant findings based upon a review of the completed questionnaires.

7.1 Data Discrepancies

Review of the summary data provided in Appendix A reveals that there appears to be considerable difference in the results between shipyards and design agents. For instance, there are numerous items such as 1.2.9 Burning Machines, where more than half of the shipyard responses indicated that the data is now being provided, but none of the design agents said that it was. Much closer agreement was obtained to the question whether the data should be provided.

As a result of the discussions that took place with some of the respondents, it was determined that the difference in the responses is due primarily to the fact that some of the shipyards felt that the data was available to the design agent if it was found to be necessary to the design agent's efforts, while the design agents were indicating that they did not get the data without specifically asking for it. The significance of this is that if the data is not available at the time the design agent needs it, the design agent's work is interrupted and delayed. Both shipyards and design agents agreed that it would be much more efficient to identify data needs as soon as possible and to have the data available when needed.

7.2 Required Data

The responses indicate a high degree of agreement that most of the items in the questionnaire would be necessary if the associated type of work were farmed out. In the vast majority of cases of "no" answers by the shipyards, it was because they do not presently farm out that type of work. When asked whether that data would be necessary if they did farm out that type of work, the answer was "yes" in almost every case.

7.3 Application to Current Contracts

In most cases, the percentages under the "Should Provide" column are greater

than under the “Now Provide” column. This indicates that the shipyards and the design agents both agree that the design agents are not now receiving all the data that they need in order to efficiently provide the shipyards with high quality products that require minimum rework. This is a significant finding that indicates that the list in Appendix B can be used immediately by all shipyards and design agents to identify data needs that have not yet been satisfied under existing contracts.

7.4 Amount of Data

There were no indications of any reluctance by the shipyards to providing information to the design agents, as long as the information was believed to be really relevant to the management or effectiveness of the design agent’s efforts. However, it appears that not all shipyards agree on exactly what information is required by the design agent. There was overwhelming agreement, particularly during discussions with shipyard and design agent personnel, that a check-off list such as that provided in Appendix B would be of great assistance in achieving understanding of, and agreement on, what really is needed and that there is a need to do so. Further, there does not appear to be any significant downside risk to the shipyard in providing more data to the design agent than is absolutely necessary.

7.5 Design Agent Role

Without complete data, the design agent is limited to the traditional design role and is unable to provide products which make maximum use of the capabilities of the shipyard. The improved productivity and efficiencies which could be achieved from concurrent engineering can not be realized without the full range of data.

8. ADDITIONAL COMMENTS

Respondents provided additional written comments, as well as many other comments during follow up discussions, that were related to when and how to use the check-off list. They also provided many comments on the management of farm-out engineering efforts. These are summarized in the following paragraphs.

8.1 Use of Check-off List for RFQs

The check-off list, Appendix B, should be used as a part of the initial request for quote for engineering services, by both the shipyard and the design agent. The shipyard should indicate what data will be made available, at least. “There is an absolute need, both at the proposal stage as well as the contract stage, to have a mutual understanding of the constraints or degree of detail required by the client. For example, if the shipyard does not have pipe bending capabilities, the design agent must maximize the use of fittings. Similarly, if a shipyard has extensive in-house standards for foundations, pipe hangers, ventilation spools, etc., the design agent, if not knowledgeable of these standards, will incur unnecessary expense and provide the shipyard with an unusable product.” The design agents believe such data should be made available with the RFQ so that they will know the scope of work they are bidding on more precisely. In their responses, the design agents can use the list to identify what information they need and tie their quote to the availability of the data indicated.

8.2 Use of Check-off List for Negotiations

The check-off list can be used during negotiations prior to the award of the engineering services contract to further define information needs, as well as to establish a schedule by which the information will be provided. This schedule would be integrated with the schedule for drawing submittal.

8.3 Timeliness of Data

Design agents stressed the need for the information to be delivered in a timely manner in order to reduce time wastage and cost. One noted that even though they had indicated on the questionnaire that the information was now being provided, some of the information was only being provided after the design agent identified the need and asked for it. Several design agents indicated that although all of the necessary information normally was received by the end of the contract, it was not necessarily provided when it was needed. This is particularly true in obtaining vendor information, but, vendor information is dependent upon purchase specification development. In the

absence of standardized equipment, this will always be a critical path sequence. Late information results in wasted effort and/or incomplete drawings being provided to the shipyard.

8.4 Keeping Data Current

Information provided to the design agent must be kept current during the course of the contract.

8.5 On-Site Representatives

The focus of most of the discussions with the shipyards and design agents was on how to most effectively manage the engineering services contract. It was universally agreed that it is essential to have at least one representative from the shipyard on-site at the design agent's facility. Experienced personnel added the following considerations:

The shipyard representatives must be very knowledgeable about at least one of the areas of work being accomplished by the design agent, so that they can provide as much direct response to questions as possible, without having to refer back to some other individual in the shipyard first. They must have commensurate decision making authority from their shipyard.

To be fully effective, the on-site representative must be proactive in assuring that the standards, schedules, etc., provided by the shipyard are actually used by the design agent. Essential steps in this process include orientation and training of both supervisory and working staff, "on-the-board" reviews and formal feedback after review of the final product. The on-site representative must be visible and accessible to all levels of the design agent's organization with a minimum of formal procedures.

For those issues to which the on-site representative is not able to provide direct answers, it is better to have the design agent engineer/designer, rather than an on-site representative speak with a designated point of contact at the shipyard to get the answer that he needs. This requires that the designated point of contact for each discipline at the shipyard be identified in advance. The POCS should be aware of the limits of their authority. Both the POC contacted and the design agent

engineer/designer should record the contact and the decisions made.

8.6 Quality Assurance Plan

The design agent's QA plan should be compatible with that of the shipyard, so that the shipyard's system will not be examining for items that were not covered by the design agent's system.

8.7 File Translation

The shipyard and the design agent should have the same system of file translation compatibility.

8.8 Design Agent Standards

An individual from one shipyard who had been his shipyard's on-site representative at a design agent, made the highly unusual suggestion that shipyards should review the design agent's standard drawing practices and standard design details. In some cases, the design agent's standards, based on experience with many shipyards, might be superior to the those in use at the shipyard and should be adopted. In other cases, it might be less difficult and expensive for the shipyard to change the design agent's drawings, or add to them rather than to try to have the design agent learn the shipyard's preferred approach.

9. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are provided:

9.1 Use of Check-off List

The check-off list contained in Appendix B should be used in the preparation of a shipyard's engineering support contract with prospective design agents. This will ensure that all of the requisite data is identified during the design agent's proposal preparation, is prepared by the shipyard and provided to the design agent when required following contract award.

9.2 Need for Direct Liaison

Use of the list provided in Appendix B will not preclude the necessity to establish good liaison, effective communication paths and manageable techniques for

establishing responsibility for controlling data transmission between knowledgeable personnel in the shipyard's and design agent's organization - but it will be an invaluable first step. The need to have knowledgeable, responsive shipyard personnel available, either on-site at the design agent's facility or through an on-site shipyard representative, was stressed by every shipyard and design agent who participated in this project.

9.3 Current Contract Reviews

Shipyards should meet with their current engineering support contractors to identify all data that is considered useful for the design agent to have and to ensure that the design agent either has the data or will be given it by an agreed upon date.

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
FROM THE CHECKLIST FOR
ENGINEERING SUPPORT SERVICES

		PERCENT(%) OF YES ANSWERS			
ITEM		SY NOW	DA NOW	SY SHOULD	DA SHOULD
1.	SHIPYARD SPECIFIC INFORMATION				
1.1	SHIPYARD ORGANIZATION				
1.1.1	Organization Plan	38%	40%	50%	80%
1.1.2	Organizational Responsibilities	38%	0%	50%	80%
1.1.3	Project Org, responsibilites	88%	40%	88%	80%
1.1.4	Telephone directory	38%	40%	38%	80%
1.2	SHIPYARD FACILITIES				
1.2.1	Maximum Lift capacity	75%		75%	80%
1.2.2	Water depth- launch & pier side	38%	20%	63%	60%
1.2.3	Type of building ways	50%	20%	63%	60%
1.2.4	Laydown ares	38%	20%	63%	60%
1.2.5	Plate limitations	75%	60%	88%	100%
1.2.6	Unit/asssembly size limitations	63%	40%	75%	80%
1.2.7	Climatic conditions	25%	20%	38%	40%
1.2.8	Paint facility	38%	0%	75%	60%
1.2.9	Burning machines	50%	0%	50%	40%
1.2.10	Welding equipment	50%	0%	63%	40%
1.2.11	Machine shop equipment	38%	0%	50%	40%
1.2.12	Pipe bending machines	63%	80%	75%	100%
1.2.13	Robotic equipment	0%	0%	13%	20%
1.2.14	Temporary service's available	13%	0%	13%	20%
1.2.14.1	Staging, lighting, HVAC etc	0%	0%	13%	20%
1.2.15	Geographfc constraints	25%	20	25%	40%
1.2.15.1	Channel depth and width	25%	20%	38%	40%
1.2.15.2	Bridge clearances	25%	40%	38%	60%
1.2.15.3	Material transportation limits	25%	20%	50%	40%
1.2.16	Other facilites	0%	20%	0%	40%
1.3	SHIPYARD CAPABILITIES				
1.3.1	Size of Workforce	25%	20%	25%	20%
1.3.2	Skill level of workforce	0%	0%	0%	40%
1.3.3	Subcontractors	63%	20 %	75%	60 %
1.3.3.1	Joiner	63%	60%	75%	80%

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
FROM THE CHECKLIST FOR
ENGINEERING SUPPORT SERVICES

		PERCENT(%) OF YES ANSWERS			
ITEM		SY	DA	SY	DA
		NOW	NOW	SHOULD	SHOULD
1.3.3.2	Electrical	25%	40%	38%	60%
1.3.3.3	Combat system	38%	40%	38%	60%
1.3.3.4	Insulation	63%	20%	75%	60%
1.3.3.5	Painting	25%	0%	38%	40%
1.3.3.6	Major equipment	50%	20%	50%	60%
1.3.3.7	Other	0%	0%	0%	20%
1.3.4	Other capabilities and limits	13%	20%	13%	20%
	HVAC	13%	0%	13%	0%
	UNION LABOR CONSTRAINTS	13%	0%	13%	0%
1.4	SHIPYARD STANDARDS AND PRACTICES				
1.4.1	Drafting practices & conventions	88%	100%	88%	100%
1.4.1.1	Dimensional control criteria	75%	100%	88%	100%
1.4.1.2	Piece marking	75%	100%	75%	100%
1.4.1.2.1	Steel, pipe, electrical, outfit	88%	100%	88%	100%
1.4.1.3	CAD/CAE/CAM	100%	80%	100%	100%
1.4.2	Material standards and practices	100%	80%	100%	100%
1.4.2.1	Material ordering conventions	88%	60%	88%	80%
1.4.2.1.1	Plates/shapes ordering standards	88%	80%	100%	80%
1.4.2.1.2	Pipe ordering standards	88%	60%	88%	80%
1.4.2.1.3	Stock material	75%	80%	88%	100%
1.4.2.1.4	Catalog material	75%	80%	75%	100%
1.4.2.1.5	Special order material	75%	60%	88%	80%
1.4.2.1.6	SY fabricated standard parts	63%	40%	100%	60%
1.4.2.2	Long lead/adv material procedure	63%	40%	88%	80%
1.4.2.3	Material list format	75%	80%	88%	100%
1.4.2.4	Hazardous material	50%	40%	63%	40%
1.4.2.5	Make/buy criteria	13%	40%	25%	60%
1.4.2.6	Material procurement documents	50%	60%	63%	80%
1.4.2.6.1	RFQ	38%	20%	50%	40%
1.4.2.6.2	Purchase technical Specs	100%	80%	100%	100%
1.4.2.6.3	Purchase order	50%	40%	50%	60%
1.4.2.6.4	Bulk material/steel/valve lists	75%	60%	75%	80%

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
FROM THE CHECKLIST FOR
ENGINEERING SUPPORT SERVICES

		PERCENT(%) OF YES ANSWERS			
ITEM		SY	DA	SY	DA
		NOW	NOW	SHOULD	SHOULD
1.4.3	Structural stds and practices	63%	80%	75%	100%
1.4.3.1	Metal forming and cutting	88%	20%	100%	60%
1.4.3.2	Welding procedures and details	88%	80%	88%	100%
1.4.3.3	Holes control	88%	80%	100%	100%
1.4.3.4	Bulkhead/deck <small>Sleeves</small>	88%	80%	100%	100%
1.4.3.5	Foundations & reinforcements	100%	80%	100%	80%
1.4.3.6	Pipe hanger supports	88%	100%	100%	100%
1.4.3.7	Cable way supports	88%	80%	100%	80%
1.4.3.8	Standard structural details	100%	100%	100%	100%
1.4.4	Lofting standards and practices	75%	60%	88%	80%
1.4.4.1	Conventions	88%	60%	88%	80
1.4.4.2	Tolerances	88%	60%	88%	80%
1.4.4.3	Nesting criteria	88%	40%	88%	80%
1.4.5	Mechanical/mach stds & practices	75%	100%	88%	100%
1.4.5.1	Shaft alignment procedures	38%	60%	63%	100%
1.4.6	Electrical stds and practices	88%	80%	100%	100%
1.4.6.1	wireways	75%	80%	100%	100%
1.4.6.2	Cable supports	75%	80%	88%	100%
1.4.6.3	Testing	63%	40%	75%	60%
1.4.7	Piping standards and practices	75%	100%	88%	100%
1.4.7.1	Fabrication practices	75%	60%	88%	60%
1.4.7.2	Bend radius	75%	100%	88%	100%
1.4.7.3	Hangers	63%	80%	88%	80%
1.4.7.4	Cleaning/flushing/testing	63%	20%	75%	60%
1.4.8	HVAC standards and practices	75%	60%	88%	80%
1.4.8.1	Manufacture/fabrication criteria	75%	40%	75%	80%
1.4.8.2	Hangers	63%	80%	75%	100%
1.4.8.3	Testing	63%	40%	63%	60%

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
FROM THE CHECKLIST FOR
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		PERCENT(%) OF YES ANSWERS			
ITEM		SY	DA	SY	DA
		NOW	NOW	SHOULD	SHOULD
1.4.9	Paint/coating stds and practices	75%	40%	88%	60%
1.4.10	Jigs/figures stds and practices	25%	0%	50%	40%
1.4.11	Test & trials stds and practices	38%	20%	50%	60%
1.4.12	Work packages stds & practices	50%	60%	63%	60%
1.4.12.1	Work package size limitations	50%	60%	63%	60%
1.4.12.2	Work package format	50%	60%	63%	60%
1.4.12.3	Work package contents	38%	60%	63%	60%
1.4.12.4	Work package numbering system	38%	60%	50%	60%
1.4.13	Engrg change stds & practices	75%	60%	75%	80%
1.4.13.1	Producibility	50%	80%	75%	100%
1.4.13.2	Value engineering	50%	80%	75%	80%
1.4.13.3	Error correction	75%	60%	75%	80%
1.4.14	Fitting/accuracy stds & practice	88%	20%	100%	40%
1.4.15	Other standards and practices	0%	0%	0%	0%

APPENDIX A
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		PERCENT(%) OF YES ANSWERS			
ITEM		SY NOW	DA NOW	SY SHOULD	DA SHOULD
2.	PROJECT SPECIFIC INFORMATION				
2.1	CONTRACT	38%	60%	38%	80%
2.1.1	CDRLs, DIDs	88%	100%	100%	100%
2.2	SPECIFICATIONS	88%	100%	100%	100%
2.3	CONTRACT DRAWINGS	50%	60%	63%	60%
2.3.1	List of dwgs by no., title & rev	88%	100%	88%	100%
2.3.2	Reproducible copy of each dwg	75%	80%	75%	100%
2.3.3	CAD/CAE/CAM data files	75%	80%	75%	100%
2.4	CONTRACT GUIDANCE DRAWINGS	50%	80%	63%	80%
2.4.1	List of dwgs by no., title & rev	88%	100%	88%	100%
2.4.2	Reproducible copy of each dwg	75%	80%	75%	100%
2.4.3	CAD/CAE/CAM data files	63%	80%	63%	100%
2.5	PROJECT PECULIAR DOCUMENTS	75%	100%	88%	100%
2.6	THIRD TIER REFERENCES	38%	20%	38%	40%
2.7	APPROVAL PROCEDURES	38%	40%	38%	40%
2.7.1	Shipyard approvals required	88%	100%	88%	100%
2.7.2	Owner approvals required	88%	100%	88%	100%
2.7.3	Regulatorybody approvals reqrd	88%	100%	88%	100%
2.7.4	Correspond & distribn procedures	75%	80%	88%	100%
2.8	OWNER DATA REQUIREMENTS	38%	20%	38%	20%
2.8.1	Integrated logistic support	63%	60%	63%	80%
2.8.1.1	Provisioning tech documentation	63%	60%	63%	80%
2.8.1.2	Spare parts	50%	80%	50%	80%
2.8.1.3	Selected record data & dwgs	75%	80%	75%	80%
2.8.2	Commereial data information	63%	80%	63%	80%
28.2.1	Procurement information	63%	60%	63%	80%

2.8.2.2	Technical manuals	75%	100%	75%	10070
2.8.2.3	Booklet of general plans	75%	80%	63%	80%
2.8.2.4	Spare parts list	38%	40%	25%	60%
2.8.3	Test and trial data	50%	80%	50%	80%
2.8.4	Training and instructions	25%	60%	25%	60%
2.8.5	Other owner data requirements	25%	20%	25%	20%

2.9	OTHER OWNER REQUIREMENTS	25%		25%	
2.9.1	Models	75%	40%	75%	60%
2.9.2	Design briefings	88%	80%	88%	80%
2.9.3	Ceremonies	50%	20%	38%	20%
2.9.4	Certifications	50%	40%	50%	40%

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
FROM THE CHECKLIST FOR
ENGINEERING SUPPORT SERVICES

		PERCENT(%) OF YES ANSWERS			
	ITEM	SY NOW	DA NOW	SY SHOULD	DA SHOULD
3.	SHIPYARD IMPOSED PROJECT SPECIFIC INFORMATION				
3.1	BUILD STRATEGY	13%	40%	13%	40%
3.1.1	Description of building plan	88%	40%	100%	80%
3.1.2	Estab unit and assembly breaks	100%	100%	100%	100%
3.2	PROPOSED CONSTRUCTION PLAN	13%	40%	13%	40%
3.2.1	SY Master Construction Plan	88%	60%	100%	80%
3.2.2	Ship construction plan	88%	40%	100%	80%
3.2.3	Unit erection plan	75%	60%	100%	80%
3.2.4	Subcontracting plan	75%	40%	88%	80%
3.3	PROPOSED CONSTRUCTION SCHEDULES	13%	40%	13%	40%
3.3.1	Time phased construction plan	88%	40%	100%	60%
3.3.2	Engineering and design schedule	100%	100%	100%	100%
3.3.3	Matr/equip reqd in yard dates	75%	40%	88%	80%
3.3.4	Vendor information reqd dates	100%	20%	100%	80%
3.3.5	Long lead time materials	88%	60%	88%	80%
3.4	PROPOSED TEST PROGRAM	13%	20%	0%	20%
3.4.1	List of tests required	38%	60%	38%	60%
3.4.1.2	Required sequence of tests	25%	20%	25%	60%
3.4.2	Test procedures required	38%	60%	38%	80%
3.4.2.1	Test procedure format & content	38%	60%	38%	80%
3.4.2.2	Test procedure numbering system	38%	60%	38%	80%
3.4.2.3	Sample test procedure provided	25%	60%	38%	80%
3.4.3	Test reports required	50%	40%	50%	40%
3.4.3.1	Test suppt reqd/pers/equipt	25%	40%	25%	60%
3.4.4	Trials agendas	38%	40%	38%	60%
3.4.4.1	Dock trials	38%	40%	38%	60%
3.4.4.2	Builders trial	38%	40%	38%	60%
3.4.4.3	Owners trials	38%	40%	38%	60%
3.4.5	Trial reports required	50%	40%	50%	40%

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
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		PERCENT(%) OF YES ANSWERS			
	ITEM	SY NOW	DA NOW	SY SHOULD	DA SHOULD
3.5	DRAWING FORMAT AND CONTENT	38%	20%	38%	20%
3.5.1	Drawing size	100%	80%	100%	100%
3.5.2	Title block layout and data	100%	100%	100%	100%
3.5.3	Drawing numbering system	100%	100%	100%	100%
3.5.4	Drawing layout	75%	40%	88%	60%
3.5.5	Bill of material format	88%	100%	100%	100%
3.5.6	General notes	88%	40%	100%	80%
3.5.7	Drafting standards	88%	60%	88%	80%
3.5.7.1	DOD-STD-100/DOD-D1000	88%	100%	88%	100%
3.5.7.2	Commercial	63%	100%	63%	100%
3.5.7.3	Level 1,2,3	88%	100%	100%	100%
3.5.8	Sample provided	88%	60%	100%	100%
3.6	CAD/CAE/CAM	38%	60%	50%	60%
3.6.1	Required CAD/CAE/CAM application	75%	100%	88%	100%
3.6.2	Shipyard CAD/CAE/CAM system	88%	100%	100%	100%
3.6.3	Degree of compatibility required	75%	100%	88%	100%
3.7	OTHER PRODUCTION INFORMATION	13%	0%	13%	0%
3.7.1	NC tapes	50%	40%	63%	60%
3.7.2	Nesting sketches	63%	60%	63%	80%
3.7.3	Template information	75%	40%	75%	60%
3.7.4	Spool sketches	63%	80%	75%	80%
3.7.5	Pipe details	75%	80%	75%	80%
3.8	LIAISON PROCEDURES	38%	20%	25%	20%
3.8.1	Responsible SY personnel	100%	80%	100%	80%
3.8.2	SY approval procedures	88%	80%	100%	80%
3.8.3	SY personnel at Design Agent	100%	80%	100%	80%
3.8.3.1	Facilities required	100%	100%	100%	100%
3.8.4	Design agent personnel at SY	100%	100%	100%	100%
3.8.5	Responsibility for meetings	75%	80%	88%	80%

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
FROM THE CHECKLIST FOR
ENGINEERING SUPPORT SERVICES

		PERCENT(%) OF YES ANSWERS			
ITEM		SY NOW	DA NOW	SY SHOULD	DA SHOULD
3.8.6	Responsibility for reports	88%	100%	100%	100%
3.8.7	Contact with owner	63%	100%	75%	100%
3.8.8	Contact with regulator bodies	63%	100%	75%	100%
3.8.9	Contact w vendors/subcontractors	75%	100%	88%	100%
3.9	CHANGE PROCEDURES	38%	20%	25%	20%
3.9.1	Change orders	100%	100%	100%	100%
3.9.1.1	Chg- ship construction contract	100%	100%	100%	100%
3.9.1.2	Chgs- engring support contract	100%	80%	100%	100%
3.9.2	Engineering changes (ECNS)	100%	100%	100%	100%
3.10	DESIGN REVIEWS	50%	40%	50%	40%
3.10.1	Responsibility	88%	100%	100%	100%
3.10.2	Procedures	88%	100%	100%	100%
3.10.3	Location	100%	100%	100%	100%
3.10.4	Schedule	88%	80%	100%	100%
3.11	QUALITY ASSURANCE	63%	40%	63%	40%
3.11.1	Responsibility	100%	100%	100%	100%
3.11.2	QA plans	63%	100%	75%	100%
3.11.3	Shipyard procedures	63%	40%	88%	60%
3.11.4	Design agent procedures	100%	60%	100%	80%
3.12	WORK TRACKING & STATUS REPORTS	38%	20%	50%	20%
3.12.1	Responsibility	88%	100%	100%	100%
3.12.2	Report content	88%	40%	100%	80%
3.12.2.1	Technical	88%	60%	100%	100%
3.12.2.2	Schedule	88%	100%	100%	100%
3.12.2.3	Financial	75%	100%	88%	100%
3.12.3	Reporting schedule	88%	100%	100%	100%

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
FROM THE CHECKLIST FOR
ENGINEERING SUPPORT SERVICES

		PERCENT (%) OF YES ANSWERS			
	ITEM	SY NOW	DA NOW	SY SHOULD	DA SHOULD
4.	REQUIRED DELIVERABLES				
4.1	DESIGN CALCS & STUDIES IDENTIFIED				
4.1.1	Complete	75%	40%	88%	80%
4.1.2	Partial	50%	40%	50%	60%
4.1.3	None	13%	0%	13%	20%
4.2	SYSTEM & ARRANGEMENT DRAWINGS	75%	20%	75%	20%
4.2.1	Structural scantling dwgs	88%	100%	88%	100%
4.2.2	General arrangement dwgs	88%	100%	88%	100%
4.2.3	Machinery arrangement dwgs	88%	100%	88%	100%
4.2.4	control space arrangement dwgs	100%	100%	100%	100%
4.2.5	Diagrams	88%	100%	100%	100%
4.2.6	Diagrammatic arrangements	88%	80%	100%	100%
4.2.7	Advanced material list	100%	60%	100%	100%
4.2.8	Material list	88%	100%	88%	100%
4.3	COMPOSITE DRAWINGS	25%	0%	25%	0%
4.3.1	Composite/multisystem dwgs	100%	100%	100%	100%
4.4	INSTALLATION/ASSEMBLY DRAWINGS	38%	20%	38%	20%
4.4.1	Unit drawings	100%	100%	100%	100%
4.4.1.1	Outfitting lists	88%	80%	100%	100%
4.4.2	Machinery packages	75%	100%	100%	100%
4.5	FABRICATION DRAWINGS	13%	20%	13%	20%
4.5.1	Pipe details/spool pieces	63%	100%	75%	100%
4.5.2	Piping hanger support details	88%	100%	88%	100%
4.5.3	Ventilation details	75%	100%	75%	100%
4.5.4	Foundation list	100%	60%	100%	80%
4.5.5	Foundation drawings	100%	100%	100%	100%
4.5.6	Hole list	88%	60%	88%	100%
4.5.7	Key list	63%	80%	63%	80%

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SUMMARY OF RESPONSES RECEIVED
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ENGINEERING SUPPORT SERVICES

		PERCENT (%) OF YES ANSWERS			
	ITEM	SY NOW	DA NOW	SY SHOULD	DA SHOULD
4.6	SCHEDULES/LISTS/BOOKLETS	38%	0%	38%	0%
4.6.1	Paint schedule	100%	100%	100%	100%
4.7	VENDOR DRAWINGS	50%	80%	50%	80
4.8	OTHER DRAWINGS	0%	0%	0%	0%
4.9	WORK PACKAGES	0%	20%	0%	20%
4.9.1	Work package master list	25%	40%	25%	40%
4.10	TEST PROGRAM DOCUMENTATION	13%	0%	13%	0%
4.10.1	Test procedure master list	38%	60%	38%	80%
4.10.2	Test reports master List	38%	60%	38%	60%
4.10.3	Test support required	25%	40%	25%	80%
4.10.4	Trial support required	25%	40%	25%	80%
4.11	MATERIAL PROCUREMENT DOCUMENTS	13%	20%	13%	20%
4.11.1	Material ordering master list	50%	40%	50%	80%
4.11.2	Spare parts sit	25%	20%	25%	40%
4.12	VENDOR DOCUMENTATION	13%	0%	13%	0%
4.12.1	Master list reqd vendor document	75%	20%	75%	60%
4.12.2	Number of copies required	63%	40%	75%	80%
4.13	TECHNICAL DOCUMENTATION	13%	0%	13%	0%
4.13.1	Master list	38%	20%	38%	60%
4.13.2	Training	25%	60%	38%	80%
4.13.3	Safety	13%	40%	25%	60%
4.14	SAMPLES OF ABOVE ITEMS PROVIDED	50%	20%	63%	80%

APPENDIX A
SUMMARY OF RESPONSES RECEIVED
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ITEM		PERCENT (%) OF YES ANSWERS			
		SY NOW	DA NOW	SY SHOULD	DA SHOULD
5.	REQUIRED SCHEDULE OF DELIVERABLES				
	Required dates for:				
5.1	Design calculations and studies	75%	40%	100%	80%
5.2	System and arrangement dwgs	75%	100%	88%	100%
5.3	Composite dwgs	88%	60%	88	80%
5.4	Installation/assembly dwgs	88%	100%	88%	100%
5.5	Fabrication dwgs	88%	100%	88%	100%
5.6	Schedules/lists/booklets	88%	80%	88%	100%
5.7	Other drawings	88%	80%	88%	100%
5.8	Vendor drawings	50%	40%	75%	80%
5.9	Work packages	63%	80%	88%	100%
5.10	Test program documentation	38%	60%	63%	
5.11	Material procurement documents	50%	60%	75%	80%
5.12	Vendor documentation	63%	40%	75%	80%
5.13	Technical documentation	63%	20%	75%	60%

APPENDIX B

Engineering Support Services Contract Checklist

This Engineering Support Semites Contract Checklist is intended to assist the shipyard and design agent to insure that the shipyard has provided or will provide the design agent with the requisite information in a timely fashion to enable the design agent to produce the contracted design services in a useable format, at the proper time and at the least cost.

1 SHIPYARD SPECIFIC INFORMATION

This section addresses information which applies uniquely to the specific shipyard and includes both physical characteristics and limitations, as well as established practices and standards.

- 1.1 Shipyard Organization
 - 1.1.1 Organization plan
 - 1.1.2 Organizational responsibilities
 - 1.1.3 Project organization, responsibilities
 - 1.1.4 Telephone directory
- 1.2 Shipyard Facilities
 - 1.2.1 Maximum lift capacity
 - 1.2.2 Water depth at launch and pier side
 - 1.2.3 Type of building ways/slab/drydock
 - 1.2.4 Laydown area
 - 1.2.5 Plate handling/bending/rolling limitations
 - 1.2.6 Unit/assembly size limitations
 - 1.2.7 Climatic conditions
 - 1.2.8 Paint facility
 - 1.2.9 Burning machines
 - 1.2.10 Welding equipment
 - 1.2.11 Machine shop equipment
 - 1.2.12 Pipe bending machines
 - 1.2.13 Robotic equipment
 - 1.2.14 Temporary Services available
 - 1.2.14.1 Staging, lighting, HVAC, etc
 - 1.2.15 Geographic constraints
 - 1.2.15.1 Channel depth & width
 - 1.2.15.2 Bridge clearances
 - 1.2.15.3 Material transportation limitations
 - 1.2.16 Computer programs in use
 - 1.2.17 Material ordering limitations

- 1.3 Shipyard Capabilities
 - 1.3.1 Size of workforce
 - 1.3.2 Skill level of workforce
 - 1.3.3 Subcontractors
 - 1.3.3.1 Joiner
 - 1.3.3.2 Electrical
 - 1.3.3.3 Combat System
 - 1.3.3.4 Insulation
 - 1.3.3.5 Painting
 - 1.3.3.6 Major equipment
 - 1.3.3.7 HVAC
 - 1.3.4 Other capabilities and limitations
 - 1.3.4.1 Union labor constraints
 - 1.3.4.2 Interface required with other vendors & suppliers
- 1.4 Shipyard Standards and Practices
 - 1.4.1 Drafting practices and conventions
 - 1.4.1.1 Dimensional control criteria
 - 1.4.1.2 Piece marking
 - 1.4.1.2.1 Steel, pipe, electrical, outfitting
 - 1.4.1.3 CAD/CAE/CAM
 - 1.4.2 Material standards and practices
 - 1.4.2.1 Material ordering conventions
 - 1.4.2.1.1 Plates/shapes ordering standards
 - 1.4.2.1.2 Pipe ordering standards
 - 1.4.2.1.3 Stock material
 - 1.4.2.1.4 Catalog material
 - 1.4.2.1.5 Special order material
 - 1.4.2.1.6 SY fabricated standard parts
 - 1.4.2.2 Long lead/advance material procedures
 - 1.4.2.3 Material list format
 - 1.4.2.4 Hazardous material
 - 1.4.2.5 Make/buy criteria
 - 1.4.2.6 Material Procurement Documents
 - 1.4.2.6.1 RFQ
 - 1.4.2.6.2 Purchase technical specification
 - 1.4.2.6.3 Purchase order
 - 1.4.2.6.4 Bulk material lists steel list, valve list
 - 1.4.3 Structural standards and practices
 - 1.4.3.1 Metal forming and cutting

1.4.3.2	Welding procedures and details
1.4.3.3	Holes control
1.4.3.4	Bulkhead/deck sleeves
1.4.3.5	Foundations and foundation reinforcement
1.4.3.6	Pipe hanger supports
1.4.3.7	Cable way supports
1.4.3.8	Standard structural details
1.4.4	Lofting standards and practices
1.4.4.1	Conventions
1.4.4.2	Tolerances
1.4.4.3	Nesting criteria
1.4.4.4	Extra stock
1.4.5	Mechanical/Machinery standards and practices
1.4.5.1	Shaft alignment procedures
1.4.6	Electrical standards and practices
1.4.6.1	Wireways
1.4.6.2	Cable supports
1.4.6.3	Test i n g
1.4.7	Piping standards and practices
1.4.7.1	Fabrication practices
1.4.7.2	Bend radius
1.4.7.3	Hangers
1.4.7.4	Cleaning/flushing/testing
1.4.8	HVAC standards and practices
1.4.8.1	Manufacturing/fabrication criteria
1.4.8.2	Hangers
1.4.8.3	Testing
1.4.9	Painting/coating standards and practices
1.4.10	Jigs and Fixtures standards and practices
1.4.11	Tests and Trials standards and practices
1.4.12	Work Packages standards and practices
1.4.12.1	Work package size limitations
1.4.12.2	Work package format
1.4.12.3	Work package contents

- 1.4.12.4 Work package numbering system
- 1.4.13 Engineering change standards and practices
 - 1.4.13.1 Producibility
 - 1.4.13.2 Value engineering
 - 1.4.13.3 Error correction
- 1.4.14 Fitting and accuracy standards and practices
- 1.4.15 Any other Standards and Practices

2 PROJECT SPECIFIC INFORMATION

This section addresses that information which applies uniquely to the specific project due to the requirements which the owner has imposed by the ship construction contract and specifications.

- 2.1 Contract
 - 2.1.1 CDRLS, DIDs
 - 2.1.2 Copy of contract
- 2.2 Specifications
- 2.3 Contract Drawings
 - 2.3.1 List of drawings by drawing number, title and revision
 - 2.3.2 Reproducible copy of each drawing
 - 2.3.3 CAD/CAE/CAM data files
- 2.4 Contract Guidance Drawings
 - 2.4.1 List of drawings by drawing number, title and revision
 - 2.4.2 Reproducible copy of each drawing
 - 2.4.3 CAD/CAE/CAM data files
- 2.5 Project Peculiar Documents
- 2.6 Third Tier References
- 2.7 Approval Procedures
 - 2.7.1 Shipyard approvals required
 - 2.7.2 Owner approvals required
 - 2.7.3 Regulatory body approvals required
 - 2.7.4 Correspondence and distribution procedures

- 2.8 Owner Data Requirements
 - 2.8.1 Integrated Logistics Support (ILS)
 - 2.8.1.1 Provisioning technical documentation
 - 2.8.1.2 Spare parts
 - 2.8.1.3 Selected record data & drawings
 - 2.8.2 Commercial data information
 - 2.8.2.1 Procurement information
 - 2.8.2.2 Technical manuals
 - 2.8.2.3 Booklet of General Plans
 - 2.8.2.4 Spare parts list
 - 2.8.3 Test and trial data
 - 2.8.4 Training and instruction
 - 2.8.5 COSAL
- 2.9 Other Owner Requirements
 - 2.9.1 Models
 - 2.9.2 Design briefings
 - 2.9.3 Ceremonies
 - 2.9.4 Certifications

3 SHIPYARD IMPOSED PROJECT SPECIFIC REQUIREMENTS

This section addresses the information which applies uniquely to the specific project which the shipyard has imposed.

- 3.1 Build Strategy
 - 3.1.1 Description of building plan
 - 3.1.2 Establish Unit and assembly breaks - drawing
 - 3.1.3 Product Work Breakdown Structure
 - 3.1.4 Pre-outfitting sequence
- 3.2 Proposed Construction Plan
 - 3.2.1 Shipyard Master Construction Plan
 - 3.2.2 Ship construction plan
 - 3.2.3 Unit erection plan
 - 3.2.4 Subcontracting plan
- 3.3 Proposed Construction Schedules
 - 3.3.1 Time phased construction plan
 - 3.3.2 Engineering and design schedule
 - 3.3.3 Material/equipment required in yard dates
 - 3.3.4 Vendor information required dates
 - 3.3.5 Long lead time materials

- 3.4 Proposed Test Program
 - 3.4.1 List of tests required
 - 3.4.1.2 Required sequence of tests
 - 3.4.2 Test procedures required
 - 3.4.2.1 Test Procedure format and content
 - 3.4.2.2 Test procedure numbering system
 - 3.4.2.3 Sample test procedure provided
 - 3.4.3 Test reports required
 - 3.4.3.1 Test support required/ personnel/equipment
 - 3.4.4 Trial agendas
 - 3.4.4.1 Dock trials
 - 3.4.4.2 Builder's trial
 - 3.4.4.3 Owner's trials
 - 3.4.5 Trial reports required
- 3.5 Drawing Format and Content
 - 3.5.1 Drawing size
 - 3.5.2 Title Block layout and data
 - 3.5.3 Drawing numbering system
 - 3.5.4 Drawing layout
 - 3.5.5 Bill of material format
 - 3.5.6 General Notes
 - 3.5.7 Drafting Standards
 - 3.5.7.1 DOD-STD-100/DOD-D1000
 - 3.5.7.2 Commercial
 - 3.5.7.3 Level 1,2,3
 - 3.5.8 Sample provided
- 3.6 CAD/CAE/CAM
 - 3.6.1 Required CAD/CAE/CAM application
 - 3.6.2 Shipyard CAD/CAE/CAM system
 - 3.6.3 Degree of compatibility required
 - 3.6.4 Control of CAD/CAE/CAM file
- 3.7 Other Production Engineering Information
 - 3.7.1 NC tapes
 - 3.7.2 Nesting sketches
 - 3.7.3 Template information
 - 3.7.4 Spool sketches
 - 3.7.5 Pipe details
- 3.8 Liaison Procedures
 - 3.8.1 Responsible SY personnel

- 3.8.2 SY approval procedures
- 3.8.3 SY personnel at Design Agent
 - 3.8.3.1 Facilities required
- 3.8.4 Design Agent personnel at SY
- 3.8.5 Responsibility for meetings
- 3.8.6 Responsibility for reports
 - 3.8.6.1 Frequency of reports
- 3.8.7 Contact with owner
- 3.8.8 Contact with regulatory bodies
- 3.8.9 Contact with vendors and subcontractors

- 3.9 Change Procedures
 - 3.9.1 Change orders
 - 3.9.1.1 Changes to basic ship construction contract
 - 3.9.1.2 Changes to Engineering support contract
 - 3.9.2 Engineering changes (ECNs)

- 3.10 Design Reviews
 - 3.10.1 Responsibility
 - 3.10.2 Procedures
 - 3.10.3 Location
 - 3.10.4 Schedule

- 3.11 Quality Assurance
 - 3.11.1 Responsibility
 - 3.11.2 QA plans
 - 3.11.3 Shipyard procedures
 - 3.11.4 Design Agent procedures

- 3.12 Work Tracking and Status Reports
 - 3.12.1 Responsibility
 - 3.12.2 Report content
 - 3.12.2.1 Technical
 - 3.12.2.2 Schedule
 - 3.12.2.3 Financial
 - 3.12.3 Reporting schedule

4 REQUIRED DELIVERABLES

This section addresses the information which the design agent is required to deliver to the shipyard under the terms of the engineering support contract between the shipyard and the design agent. This section addresses whether the shipyard and the design agent have clearly identified all of the deliverables required by the shipyard from the design agent.

- 4.1 Design Calculations and Studies Identified
 - 4.1.1 Weight Estimate
 - 4.1.2 Inclining Experiment Report
- 4.2 System & Arrangement Drawings
 - 4.2.1 Structural Scantling drawings
 - 4.2.2 General Arrangement Drawings
 - 4.2.3 Machinery Arrangement Drawings
 - 4.2.4 Control Space Arrangement Drawings
 - 4.2.5 Diagrams
 - 4.2.6 Diagrammatic Arrangements
 - 4.2.7 Advanced material list
 - 4.2.8 Material List
 - 4.2.9 Compartment and Access Drawings
- 4.3 Composite Drawings
 - 4.3.1 Composites/multi-system drawings
- 4.4 Installation/assembly Drawings
 - 4.4.1 Unit drawings
 - 4.4.1.1 Outfitting Lists
 - 4.4.2 Machinery packages
- 4.5 Fabrication drawings
 - 4.5.1 Pipe details/spool pieces
 - 4.5.2 Piping hanger support details
 - 4.5.3 Ventilation details
 - 4.5.4 Foundation list
 - 4.5.5 Foundation drawings
 - 4.5.6 Hole list
 - 4.5.7 Key List
- 4.6 Schedules/lists/Booklets
 - 4.6.1 Paint schedule
- 4.7 Vendor Drawings
 - 4.7.1 Vendor Geometry Drawings
 - 4.7.2 Vendor Compliance Drawings
 - 4.7.3 Vendor MilSpec Drawings
- 4.8 Other Drawings
 - 4.8.1 Closure Lists

- 4.8.2 Label Plates
- 4.8.3 Cableways
- 4.8.4 Lighting
- 4.8.5 Shafting
- 4.8.6 Joiner
- 4.8.7 Insulation
- 4.8.8 Deck Covering

- 4.9 Work Packages
 - 4.9.1 Work package master list

- 4.10 Test Program Documentation
 - 4.10.1 Test procedure master list
 - 4.10.2 Test reports master list
 - 4.10.3 Testing support required
 - 4.10.4 Trial support required

- 4.11 Material Procurement Documents
 - 4.11.1 Material ordering master list
 - 4.11.2 Spare parts list
 - 4.11.3 Inquiry Specifications
 - 4.11.4 Purchase Specifications

- 4.12 Vendor Documentation
 - 4.12.1 Master list of vendor documentation required
 - 4.12.2 Number of copies required

- 4.13 Technical Documentation
 - 4.13.1 Master list
 - 4.13.2 Training
 - 4.13.3 Safety

- 4.14 Have samples of above items provided

5 REQUIRED SCHEDULE OF DELIVERABLES

This section addresses the schedule on which the design agent is required to provide the deliverables to the shipyard under the terms of the engineering support contract between the shipyard and the design agent. The items in this section address whether the shipyard and the design agent have established the required dates for the deliverables to the shipyard in order to perform to the contract and specifications.

- 5.1 Required Dates for Design Calculations and Studies

- 5.2 Required Dates for System and Arrangement Drawings
- 5.3 Required Dates for Installation/Assembly Drawings
- 5.4 Required Dates for Fabrication Drawings
- 5.5 Required Dates for Schedules/lists/Booklets
- 5.6 Required Dates for Other Drawings
- 5.7 Required Dates for Vendor Drawings
- 5.8 Required Dates for Work Packages
- 5.9 Required Dates for Test Program Documentation
- 5.10 Required Dates for Material Procurement Documents
- 5.11 Required Dates for Vendor Documentation
- 5.12 Required Dates for Technical Documentation

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